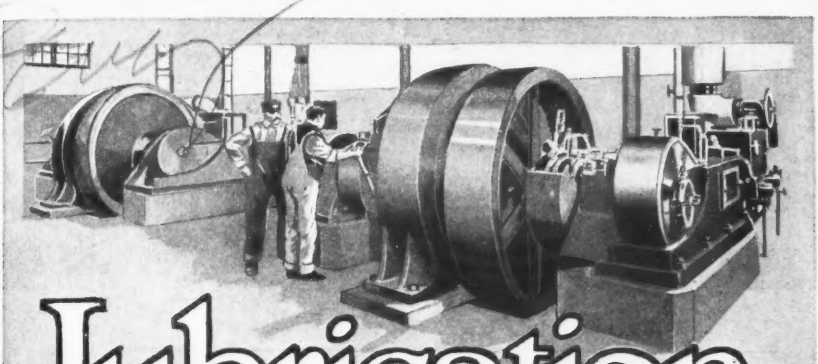

Lubrication

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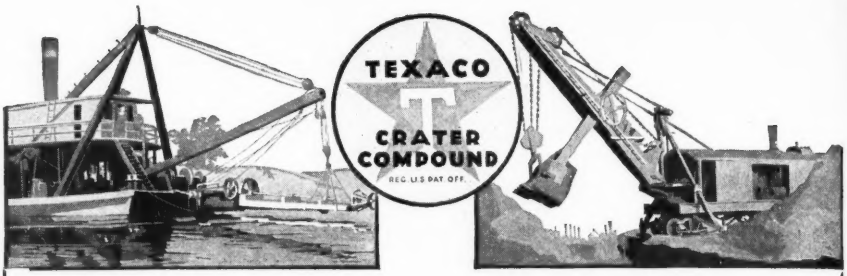

For Heavy Duty

ON the theory that a steam shovel or a dredge is a strong, sturdy machine and needs little attention, frequently operators neglect the question of lubrication.

Yet, it is a vital consideration, if the greatest amount of work with the least number of delays for repair and overhauling are to be obtained.

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It prevents the too-rapid wear of gears and pinion, occasioned by contact with sand, rock, mud, and water.

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Petroleum and Its Products

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LUBRICATION

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EDITORIALS

At a time like the present when the demands for lubricating oil are greater than ever before and when the proper lubrication of Uncle Sam's battleships, cruisers, destroyers, submarines, etc., is of such vital importance, it is a matter of great pride to The Texas Company that it has been called upon to shoulder, practically unaided, the burden of supplying lubricating oil to the United States Navy operating on the Atlantic seaboard and in European waters. Few have stopped to consider the exacting nature and the wide range of requirements of the United States Navy, and the fact that The Texas Company has been asked to fill these requirements for the coming critical year is adequate proof of the satisfaction which the Company has rendered to the Navy during the past few years, both as to the quality of the products supplied and as to the service in delivering these products at the proper time and place. The award of this contract to The Texas Company should inspire confidence in every engineer as to the ability of the lubricants marketed by The Texas Company to successfully meet his requirements, and also as to the service rendered by the company.

The article on the method of conducting tests of lubricants on internal combustion engines was originally prepared by Mr. S. F. Lentz for a meeting of The Texas Company engineers, recently held at New York. It required very little revision of this article, however, to make it apply generally to tests of any oils, and we trust that engineers who are interested in securing the most suitable oil for internal combustion engines will find this article of value. We should like to emphasize, however, the fact that The Texas Company has a corps of efficient engineers who are always ready to make comparative tests along the lines suggested by the article, without incurring any obligation whatever upon those for whom the tests are made. This constitutes an important phase of the service rendered by our engineering department, a service, by the way, which is also available for all users of Texaco lubricants to assist them in solving lubricating problems.

THE LUBRICATION OF UNCLE SAM'S NAVY AND TRANSPORTS

By Frank J. Shipman

DURING recent years I have had the pleasure each year of writing an article for *Lubrication* calling attention to the award to The Texas Company of a contract for a very large percentage of the lubricating oils to be used by the United States Navy. In 1916, for example, we referred to the fact that the contract for over 99 per cent. of the total requirements of the Navy at all ports was awarded to The Texas Company. Items for 1916 included Texaco Neptune Marine Engine Oil, Texaco Pinnacle Mineral Cylinder Oil, Texaco Spica Oil, Texaco Algol Oil, Texaco Ursa Oil, Texaco Alcaid Oil and Texaco Cetus Oil. During the fiscal year ending June 30, 1917, over a million gallons of lubricating oil were delivered to the Navy.

The award for 1917 was practically a renewal of the contract for the preceding year. Three new oils were added to the list, namely, Texaco Altair Oil, a straight mineral oil having a viscosity of 500 seconds at 100 degrees, suitable for the lubrication of main engines with wick or hand feed, Texaco Hot-running Torpedo Oil, and Texaco 650 T Mineral Cylinder Oil.

While the contract for 1917 called for something like a million gallons of oil, actual deliveries exceeded this estimate many times, due to the activity of the naval vessels as a result of the declaration of war. The fact that the Navy Department has decided not to change horses while crossing the stream shows that Texaco lubricants have been as satisfactory under the stress of war as in the less exacting times of peace. The contract awarded by the Bureau of Supplies and Accounts of the United States Navy Department to The Texas Company for 1918 is again virtually a renewal of the contract for the preceding year. The following list shows the oils to be used for power machinery only for United States naval vessels operating in American waters and in overseas service. In addition to this list The Texas Company was given a contract for Air Compressor Cylinder Oil, namely, Texaco Alcaid Oil, and Light Mineral Lubricating Oil for Torpedo Lubrication, namely, Texaco Regal Oil:

Texaco Lubricating Oils which will be supplied by The Texas Company—Contract No. 38998 with the Navy Department, Fiscal year ending June 30, 1919.

Atlantic Ports, Class 89, Items 1-2-3-4-5-6-7-8-9.

Pacific Ports, Class 90, Items 1-8.

Oriental Ports, Class 91, Items 1-8-f. o. b. San Francisco.

Atlantic and Gulf Ports, Class 93, Items 1-2-3-4-5-6-7-8.

Item 1—*Texaco Pinnacle Mineral Cylinder Oil.*

Viscosity 130″ at 210 deg. F. A heavy mineral cylinder oil possessing fine lubricating qualities, for use on piston and valve rods; can be used under all conditions of steam.

Item 2—*Texaco Spica Oil.*

Viscosity of 100″ at 100 deg. F.; cold test 5 deg. below zero F. For lubrication of the compressor and expander cylinders of ice machines and for pneumatic tools. It is light in body and color; can be used in hydraulic systems; also for cleaning small arms. Will not gum or corrode.

Item 3—*Texaco Algol Oil.*

A heavy oil. This is straight mineral oil, has a viscosity of 500″ at 100 deg. F.; cold test 5 deg. F.; will not saponify or mix with water. For lubrication of internal combustion engines of motor boats, submarines and aeroplanes; also for lubrication of main engines on forced feed; for turbines of heaviest type; on Destroyers having a combination of turbines and reciprocating engines.

Item 4—*Texaco Alcaid Oil.*

A medium oil. Viscosity of 300″ at 100 deg. F.; zero deg. cold test. An excellent turbine and forced lubrication oil if one of this viscosity is desired. For lubrication of internal combustion engines of motor boats, submarines and aeroplanes, Torpedo Air Compressors, Cylinders and bearings.

Item 5—*Texaco Cetus Oil.*

A light oil. Viscosity of 200″ at 100 deg. F.; zero cold test. For turbines, dynamos and internal combustion engines, where a light viscosity oil is desired, and for general oil about ship.

Item 6—*Texaco Ursa Oil.*

An extra heavy oil. This is a straight mineral oil, has a viscosity of 750″ at 100 deg. F.; cold test is 5 deg. F.; recommended for lubrication of large internal combustion engines of motor boats, submarines and aeroplanes; also for lubrication of main engines on forced feed; for turbines of heaviest type; or Destroyers having a combination of turbines and reciprocating engines; also Diesel engine cylinder, air compressors and bearings.

Texaco Motor Oil B.

An extra heavy straight mineral oil for internal combustion engines only.

Item 7—*Texaco Altair Oil.*

This is a straight mineral oil, has a viscosity of 500″ at 100 deg. F. This oil is dark red in color. Will not saponify when mixed with water as readily as a compounded oil. Suitable for lubrication of main engines (for wick or hand feed).

Item 8—*Texaco Marine Engine Oil.*

This is a compounded oil made to saponify with water, for lubrication of reciprocating engines and auxiliaries where oiling is done by hand or thru wick feed or drop oilers; also thrust bearings. This oil is not suitable, nor intended for other purposes.

Item 9—*Texaco 650 T. Mineral Cylinder Oil.*

This is a straight mineral cylinder oil; has a viscosity of 150″ at 210 deg. F.; is recommended for lubrication of steam cylinders using superheated steam.

The Navy Department is probably the largest single user of lubricating oils; therefore they must be very particular as to the kind and quality of lubricating oils purchased. To aid them in determining the kind of lubricants to use, the Navy Department established The Naval Experiment Station for the purpose of testing lubricating oils for use on the power machinery of naval vessels. This station is one of the best, if not the best, equipped oil laboratory in America.

Each and every one of the Texaco oils furnished to the Navy Department has undergone severe chemical and physical tests at the Experiment Station* and has been tested under practical observation for a number of months on naval vessels before we were permitted to furnish it for use generally to United States naval vessels.

The impression has prevailed from time to time that the Navy Department's purchases of lubricating oils were dependent upon price, and that oils were purchased under specifications, but this opinion is entirely wrong. It has been proven many times that good oils might be purchased under specifications which would permit of furnishing inferior oils, and due to this fact the system of specifications has been entirely eliminated. Those who furnish oils to the United States Navy Department must keep up their standard of quality at all times to meet the samples submitted to the Experiment Station for test. Constant watch is kept and inspection is made on all lubricants furnished to various naval vessels, and no inferior oil is accepted.

That Texaco Lubricating oils have passed through these severe tests should be an indication to users of Texaco lubricants, as well as to non-users, that there is a large margin of safety in the use of Texaco products.

*The procedure in connection with testing oils is very clearly set forth in an article by Lieut. Commander H. T. Winston, U. S. Navy, in the *Journal of the Society of Naval Engineers*, May, 1916, p. 25, "Navy Lubricants and Lubrication." Copies of this article may be obtained from the Society of Naval Engineers, Washington, D. C.

METHODS OF CONDUCTING TESTS OF LUBRICANTS ON INTERNAL COMBUSTION ENGINES

By S. F. Lentz, Engineer, The Texas Company

THE method of conducting a test of lubricants on internal combustion engines depends pretty largely upon three things, viz.: type of engine, whether it has been installed and is already operating or is yet in the builder's factory, and the facilities for carrying out the test as it should be conducted.

Owing to these three things it is practically impossible to lay down a certain procedure to be followed in all cases, although in each case it is possible to bring out more or less the same determinations, which enable one to judge the value of the lubricant.

Under types of engines may be classified stationary engines, both large and small, and mobile engines, such as automobile, tractor, aeroplane, etc. Methods of lubrication, whether forced-feed, splash, or combination of both, will also sub-classify the above to a certain extent, and if the lubricating method is forced-feed, it must be taken into account whether the pump is of the sight-feed or flushing type.

If the engine is one that is operating under actual working conditions it is not always easy to take sufficient time to properly clean the working parts before starting the test, or of making a detail inspection of parts after a test run; nor is it possible in the above case to have all the conveniences necessary to bring out all the important points.

When the test is made in the factory with the engine yet on the testing blocks, time to disconnect and assemble for cleaning and inspection of parts is not such an important factor, and at the same time most of the needed instruments and appliances for various determinations are regularly at hand.

Rather than attempt to draft a set form to be followed in making an internal combustion engine test it seems better to outline the different points which are usually considered and which should be tabulated when judging the relative values of lubricants. These points are discussed below in approximately the same order as they naturally come to the attention in starting and making a test. Several of these apply particularly to stationary engines or to mobile units on block test. However, it is easy to modify them as necessary to fit such tests as automobile road tests, tractor field tests, etc.

1. *General Description of Engine*—A general description of the engine is very necessary and should be complete with regard to make, type, peculiarities of design, size, lubricating system, etc. In fact, the more information collected about the engine itself, the easier it will be to prepare the report of the test to show actual results.

2. *Details of Mechanical Conditions.*—The present condition of the engine as a whole must be noted and tabulated, as this has a great influence upon fuel consumption, etc. This should include inspection of ignition apparatus, carburetors or fuel injectors, timing and working conditions of valves, cylinders and bearings, also, as most engines have

certain peculiarities known only to the man in charge, it is well to get all information possible from him. Before the test is started the bearings, crank-case, etc., should be thoroughly cleaned with kerosene to remove all traces of the former product. Gasoline is not as desirable for washing purposes as kerosene. Any carbon or other deposits in the cylinder or cylinder head, on the pistons and in the ring groove, must be scraped away.

After the oil to be tested is introduced the engine should be operated for from one to five hours, according to size, before beginning to take test data, so that the new oil film may have time to thoroughly cover all parts.

3. *Duration of Test.*—The total time the engine is in operation should be kept, divided into idle running and load running time, with a note of the stops and starts, if any. A greater proportion of fuel is consumed while the engine is picking up speed than while it is operating at constant speed. Pressures in cylinder will be higher, also, and combustion will not be so good until full speed is reached. Thus, there is a greater chance that part of the combustion pressure will be wasted by passing the piston and that unconsumed portions of the fuel will follow the same path, contaminating the oil in the crank-case.

There is no set period of time over which a test should be carried, the size of the engine, local conditions, the time, element, etc., all having to be considered. However, too short a period should be avoided, as extended use only can be depended upon to bring out clearly the value of a lubricant. In the case of stationary engines nothing under ten hours should be considered, and three times that period would be better. However, on small sizes this time could be reduced to say five hours. Mobile units on block test also should have from five to ten hours run, while an automobile or truck road test should extend over a distance of from 200 to 500 miles for the former and from 50 to 100 miles for the latter. Working tests of tractors should cover a couple of days at least.

4. *Engine r. p. m.*—The speed of the engine should be taken at regular intervals throughout the test, the number of readings varying from six to one per hour according to the period of time the test will cover.

A hand speedometer or a revolution counter is better for obtaining speed readings than a tachometer. When comparing the results obtained with different lubricants, provided no adjustments have been made meanwhile, average engine speed will give a good indication of cylinder lubrication. A poorly lubricated cylinder will cause the engine to drag, this being evidenced by the fact that any stationary engine will run from two to eight r. p. m. faster with a high grade product than with an inferior product.

5. *Engine Load.*—To obtain absolutely accurate data as to the fuel consumption and general working conditions, the load on the engine should be held as nearly constant as possible. Of course this can be done only when the engine is connected to a Prony brake or dynamometer of other design. Where the engine is tested under operating conditions, the load in most cases will vary greatly. It will then be necessary at regular periods, say each time the speed is recorded, to note the machines being driven at that moment if the engine is driving a line shaft; or, to record the ameter readings each time if a generator is being driven. The greater the load the more power is necessary to pull

it, thus, the greater will be the combustion pressure, which means harder conditions for the oil to work under. A poor oil might be successful in an engine operating at one-half or three-fourths load, while the same engine pulling full load or slight over-load could operate on nothing but an efficient lubricant.

6. *Fuel Consumption.*— Where possible, fuel consumption during the test should be very carefully taken, as it will decrease or increase in direct proportion to the lubricating value and seal-forming properties of the lubricant, it being presupposed, of course, that mechanical conditions are as they should be. Fuel readings may be taken each time the speed of the engine is taken, and the best way to obtain them is by weight. A small tank holding ten to twenty gallons can be placed on a platform scale of sufficient capacity to weight that quantity of fuel, and the whole thing mounted high enough to allow the fuel to feed the engine. The connection between the tank and the engine fuel pipe should be a very flexible hose which will have very little effect upon the balancing of the scale. The weight of the tank and fuel is taken at the start and at regular periods thereafter. This will permit of the fuel consumed being easily calculated in pounds per h. p. If such an arrangement is not possible, the depth of the fuel in the main supply tank should be measured at regular intervals, it being then only a matter of finding the number of gallons contained in the tank for each inch in height.

7. *Lubrication System.*— It is necessary that every detail concerning the lubrication system be taken into consideration. If a force-feed sight lubricator is in use, the quantity fed is under the absolute control of the operator, and, while running the engine, before starting to take readings, the drops per minute to any part of the engine should be gradually reduced to the lowest possible point. The location of the lubricator must also be taken into account. If attached to the top or side of the cylinder, the oil in it will be greatly lowered in viscosity before entering the cylinder. If oil is supplied to the cylinders by splash, it is important that the depth of the dip of the crank be noted. Also if bearings are supplied by force-pump, the pressure should be noted. The latter conditions have a bearing on the oil consumption through the rapidity of circulation and the volume splashed against hot surfaces.

8. *Lubricating Oil Consumed.*— All new oil placed in the lubricator or crank-case should be carefully measured, and if a sight-feed lubricator is used it is well to make note of the drops per minute, as this will give a check on measured quantities when comparing different products. If tin measures are used, they should be supplied in quart, pint, and one-fourth pint sizes. However, for really accurate work it is much better to use a tall, straight side, graduate, having a capacity of 250 c.c. Measuring vessels of any kind should be drained a moment or two each time they are emptied, or else considerable oil will remain clinging to the sides, which will cause inaccuracy.

9. *Condition of Oil After Use.*— If the cylinder has splash lubrication, the condition of the used oil will give a good indication of how well it is performing its work. Naturally, only laboratory analysis will show how badly it has been affected; hence, samples for analysis should be taken in all cases. However, a visual comparison with the new oil will give an idea of the content of

unconsumed fuel, the latter making the used oil very thin and showing whether or not a piston seal was formed and maintained.

The percentage of the used oil reclaimable should be taken into consideration, this being especially important with certain types of large engines which have force-feed lubrication to all parts and in which the drip from the bearings is mixed with the cylinder drip.

10. *Room Temperature.*—This should be recorded each time other readings are taken. Other temperature readings minus room temperature will show the net or actual friction and combustion temperatures.

11. *Temperature of the Jacket Cooling Water.*—The temperature of the jacket cooling water should be recorded for both inlet and outlet at the same time other readings are taken. The net temperature of the cooling water shows approximately the temperature of the cylinder walls and this is important in making comparisons, for the viscosity or piston sealing quality of the lubricant decreases as the temperature is raised. The higher the temperature of cooling water, the hotter will be the engine parts against which the oil is splashed, which has a great bearing on oil consumption. Jacket temperatures have an influence upon the temperatures of the oil in the crank-case and also upon bearing temperatures through conduction, although a run of at least several hours must be made to affect the bearings. It is a good plan to regularly record temperatures of oil in the crank-case whenever it is possible to do so. Temperatures may be taken with any ordinary thermometer, but a thermometer about twelve inches long having an eye moulded in the glass at the top seems to suit the greatest number of conditions. They are calibrated in single degrees and read to 200 degrees.

12. *Temperatures of the Engine Bearings.*—It is well to take the bearing temperatures even when the oil is not being tested at that point, as in testing a stationary engine having separate lubrication to the bearings. High bearing temperatures indicate wasted power which affects the load which it is possible for the engine to deliver, and thus, indirectly, affects fuel consumption.

13. *Condition of Cylinder Walls at the Finish of the Test.*—The condition of the cylinder walls upon the completion of the test is a very important point to note, as it shows very clearly just what the oil has been doing. Of course the determination is more easily made in the larger cylinders of stationary engines. The walls should be free from carbon deposits and from dry or burnt spots and should be covered with a very perceptible film of free oil. This film should extend to the limits of the stroke. If 15 to 30 per cent. of that part of the cylinder which is exposed to actual combustion is perfectly dry and even rusty in spots, with perhaps a corresponding length of the piston in the same condition, with one or two piston rings burnt in solidly, no explanation is needed as to how such conditions will affect engine operation.

For comparison, the thickness of the oil film on the cylinder walls may be measured by its penetration through Rizla-Croix cigarette paper, in the following manner: a small block of wood is cut to the arc of a circle having the same radius as that of the cylinder, and to this arc is bound a pad of the papers. Upon the removal of the cylinder head immediately after the engine is stopped, this pad is held against the

cylinder walls with the same pressure for a certain period of time. If there is any film present, the oil will penetrate one or more papers, which are uniformly .001 of an inch thick. A penetration of .002 of an inch in one minute is very good. This measurement of oil film with each oil under test should be taken at the same point of contact on the cylinder walls—the same pressure and for the same length of time.

14. *Carbon Deposits.*—Examination of the cylinder, piston and cylinder heads for carbon deposits should be made immediately at the end of the test run. Both quantity and quality must be noted, although it will be found that quantity depends upon quality. Carbon should be of a talcum-like, fluffy nature. If a small quantity of carbon of this nature develops, it can be shown that the deposit will not grow larger, while if it is of a hard and flinty nature, it will continue to build up. As mentioned earlier in this paper, it is desirable that every trace of deposit of the former lubricant be removed before introducing the oil to be tested.

15. *Condition of Spark Plugs or Hot-Head.*—If the engine has electric ignition, poor operation will result and considerable time will be lost in changing spark plugs, should they become easily and badly carbonized. Carbon from some oils is little more than soot, which does not affect the spark gap and which can easily be blown clean from the points. Other oils cause a carbon which will eventually prevent a spark and which will have to be scraped away. Engines using "hot-head" ignition are troubled also with carbon building up in the head, becoming incandescent, and causing premature ignition. In this case the carbon comes mostly from the fuel oil.

16. *Atmospheric Conditions.*—The general operation of an internal combustion engine is affected by weather conditions, and this must be taken into consideration when comparing test results. An automobile will run better on less fuel at night, when the air is heavier, than it will in the hot sun; and so, any engine is affected by a cloudy or a damp day. As this difference is difficult to judge it is much better that comparative tests be made on days when atmospheric conditions are similar.

17. *Engine Compression.*—Considerable light can be thrown upon the action of a lubricant in forming a piston seal by the engine compression, this applying to any size or type. The engine should be turned over slowly by hand, the crank or fly-wheel, as the case may be, being released at the point of highest compression. Thus may be noted the distance of travel in rebound caused by the compression. Trying this before and after the test of the new oil may show a considerable difference. In turning the engine crank, one must not mistake a drag, caused by tight or poorly lubricated bearings, for compression.

18. *General Operation.*—Throughout the period of the test the general operation of the engine should be observed and noted. This applies to ease of starting, differences in apparent power, ease of maintaining constant temperatures, etc. Also in an automobile road test, the greatest acceleration possible to obtain should be noted, mention being made of road and wind conditions.

19. *Summary.*—After the completion of the test it is well to thoroughly go over all conditions under which the test was made, as in this way the reason for certain results may be found, which would apparently be unexplainable.

In all of the above it is presupposed that actual comparative tests are to be made; that is, a test with the old and the new product in the same engine, this being the best possible method by which one oil can be shown to be superior to another.

If the test can be run with the new lubricant only and no information concerning the action of the other oil is obtainable, it is most important that the testing engineer carefully bring out every point in the test that will in any degree show its value.

Needless to say, comparative tests must be absolutely fair for each product, and test conditions should be exactly the same.

It should always be insisted upon that some employee of the firm to whom the engine belongs check all data as it is obtained, that is, verify the temperature readings, fuel and oil measurements, etc.

As mentioned before, local conditions prevent the adoption of any set rule for carrying out tests of oils in an internal combustion engine, so that the method of test must be decided by the engineer after he is on the ground. He can, however, obtain data on all of the points outlined, and many times others will appeal to him as being important also. The one rule which can be followed under all circumstances is that nothing be left out; that no information developed—even that of a seemingly unimportant nature—be cast aside, and, above all, that nothing be taken for granted that can be proven.

LUBRICATION OF STEAM SHOVELS AND DREDGES

A STEAM shovel or dredge, like any other piece of mechanical equipment, will give ample return for the time and attention given to its proper up-keep. Because of the rough work which these machines have to perform, and because of their general sturdy and serviceable construction, this fact is sometimes lost sight of. One of the most important features of their up-keep is the use of proper lubricants, which has a bearing both on the useful life of steam shovels and dredges and on the frequency with which they are laid up for repairs.

Steam shovels and dredges, owing to the nature of their work, are generally operated in more or less inaccessible places, many miles from a repair shop or source of supply of new parts. As the interest and depreciation charges on such expensive equipment amount to a considerable sum, each day's shut-down necessary for replacement of bearings and worn parts entails a very considerable loss to the owner. If this lost time can be reduced thru the selection and use of proper lubricants or thru proper application of suitable lubricants, a saving many times greater than the original cost of the oil will be effected.

Engines.—While the principles of operation of steam shovel engines are similar to those of the ordinary stationary engine, they operate under more severe conditions; first, because of the temporary and unlevel nature of the track on which they are required to operate, which imposes severe strain; second, because of the wide and rapid variations of load; third, because of the nature of the boiler water used,

which is generally found to vary with each change of locality. On account of these severe conditions, the oil for the lubrication of the cylinders of such engines must be of a very high grade to stand up under such adverse circumstances. If there is to be any saving on repairs, on piston rings and cylinders, and on steam consumption (which means a reduction in fuel burned), the oil used must have the right characteristics.

The cylinder oil must be capable of lubricating the pistons and cylinders thru a sudden change of load. This rapid changing of the load on the engine has a tendency to cause the boiler to prime, especially if a high water level is carried. Shots of water, which frequently come over, will wash the cylinder oil off the cylinder walls and, in many instances, this boiler water contains a considerable percentage of alkali which has a very bad effect on the sticking qualities of the oil, unless properly prepared to meet these conditions. Experience has demonstrated that a cylinder oil should be compounded with the proper amount of animal oil to resist the chemical action of the water and permit of a film of oil to adhere to the cylinder walls. Because of the wide variation in operating conditions, it is not feasible to sell one brand of cylinder oil with the assurance that it will be satisfactory under all conditions. In general, however, it may be said that a high grade oil of proven qualities will be the cheapest in the long run.

When working steadily, the operator has no time to give to adjustment of the oil supplied to the cylinders. It is, therefore desirable to use a dependable automatic lubricator for all of the engines—hoisting, dipper and swinging—as well as for the pumps. When the engines are idle the lubricants are conserved, but the moment operations are begun the oil is supplied simultaneously to each of the engine cylinders. For the lubrication of piston and valve rods, swabs saturated with a cylinder oil should be used.

Bearings.—Where bearings are so constructed as to make it possible, a good grade of medium grease should be used, one which will not thin down excessively in hot weather nor become so hard in cold weather that an extreme temperature is required to melt it to provide lubrication. For guides, use a good viscous oil of sufficiently heavy body to resist the rubbing action of the shoe. Some engineers are in the habit of mixing black oil and other cheap oils for this purpose, but this practice is wasteful and ineffectual. Such a mixture cannot be made uniform. As there is no possibility of judging correctly the viscosity or body of the mixture, there can be no certainty as regards its performance. On the other hand, a good straight mineral oil, properly manufactured, will maintain its body in continuous service.

While extremely cold weather usually forces a discontinuance of operation of steam shovels and dredges, where it is found necessary to operate in severe weather a lubricant of sufficiently low cold test to prevent its solidifying and refusing to flow to the bearing surfaces should be used.

Journal Boxes.—Journal boxes are usually of the railway type and are lubricated in a similar manner by means of wool waste saturated with oil. While the service of the journal box of this equipment cannot be compared to that of railway journals which run at high speeds for many miles without stopping, it is, nevertheless, advantageous to use a good

grade of oil, such as is used for general bearing lubrication.

Gears, Pinions, Cables, etc.—Important parts subjected to the most severe service, and usually receiving the least attention, are the gears, pinions, racks, cables and chains. Steam shovel operators are just beginning to give attention to the lubrication of such parts, having learned how the entire operation of the steam shovel can be improved by a little care and attention. These gears, pinions, cables and chains should be kept lubricated at all times. Noisy gears and rusty ropes are the result of lack of lubrication or use of an improper lubricant. Allowing them to run dry means wear and consequent expense due to loss of time and replacement of parts.

To properly care for the gears, the lubricant must possess certain qualities. Fortunately these qualities are identical with those required for lubrication of chains and cables, as this reduces the number of lubricants to be carried on the steam shovel. In steam shovel duty, the heavy loads applied suddenly, and the continuous starting, stopping and reversing place a severe service upon the pinions and gears. The mud, sand and rock dust with which they come in contact, tend to cut and wear the gear teeth very rapidly. The gear lubricant, therefore, must be of sufficiently heavy body to meet these conditions, maintaining a lubricating film on the teeth under extreme pressures. It must have the faculty of adhering to the metal and should resist the pressure so as not to be squeezed out from between the gear teeth or from between the strands of cables. It must be adhesive and pliable so that it will not roll up in balls and fall off the teeth when mixed with rock dust or sand. It must remain pliable when exposed to low temperatures, and should not run or drip in hot weather. Because of the water which a steam shovel or dredge encounters in its daily performance, the gear or cable lubricant must resist the action of neutral as well as of acid or alkali water. It should be homogeneous so that there will be no separation or chemical action after it is applied. Many so-called gear lubricants are mixed with materials of a non-lubricating character put in them to give body and adhesiveness, and after they have been in use a short time the oil which they contain evaporates, leaving the filler as the sole protector.

The best way to lubricate gears is to clean them and then paint them with a stiff brush. Where this is not possible, the lubricant may be poured, when the gears are running, from a can or container having a small opening onto the teeth of the gears at the point of meshing. If the right lubricant is used, it will not only take care of hoisting gears, swinging gears, and dipped handle gears and rack, but can also be used for dipper handle slides, trunnion and trunnion tracks; in fact, wherever great pressure occurs. Texaco Crater Compound has been specially manufactured to meet these conditions and has been eminently successful.

As stated before, such lubricants will prove highly efficient on the cable, due to their adhesiveness providing a good coating on all of the wires at all times and, if properly applied, will afford protection from wear, from the elements, and from corrosive waters. To lubricate the cables when in use, care should be taken first to see that they are dry and then to run them slowly over the drum, pouring the lubricant on slowly in a fine stream. This will also lubricate the grooves of the

sheaves. The portion of the rope which does not pass over the drum, but which should have some protection, may be painted with a stiff brush. In putting on a new cable, very satisfactory results may be obtained by treating it in the following manner:

First, have the wire rope manufacturer lay up the rope in a suitable lubricant during the process of manufacture. In this way, the hemp center will be saturated with the lubricant which will provide the initial lubrication and protect the rope until put in service.

Second, upon receipt of the new rope from the manufacturer, while the strands are still open, immerse it in a tank full of the lubricant heated to about 250° F. This will coat the outside wires and, what is of greatest importance, will permit the lubricant to penetrate to the hemp center, further saturating it and lubricating all of the strands. This saturating with a chemical-resisting lubricant provides a defense against corrosion of the inner wires, protects the hemp core from rotting and keeps it pliable and soft. When the rope is in operation, bending over the sheaves and drums, a slight amount of lubricant will be forced out between the wires which will afford lubrication when and where it is most needed.

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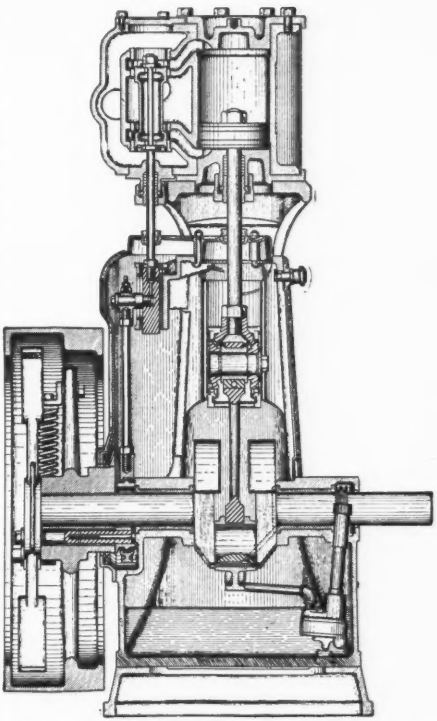

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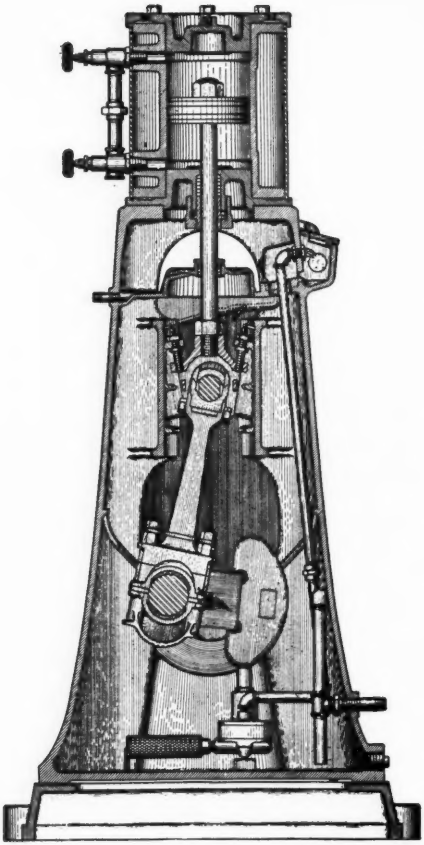

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An Engineer made the following report after these tests were completed:

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We are only too glad to add "Alcaid Oil" to our approved lists.

Yours very truly,

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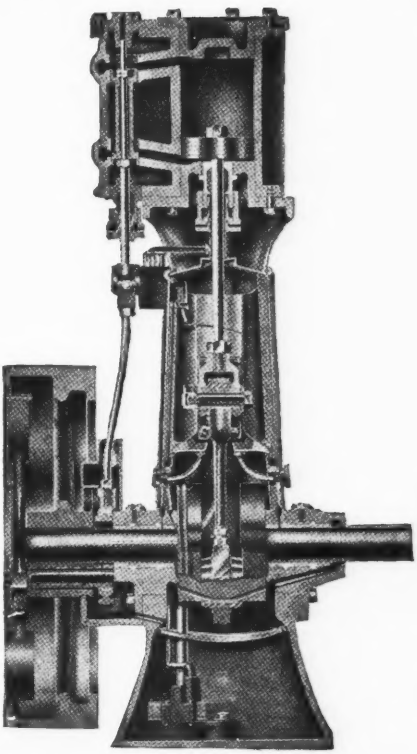

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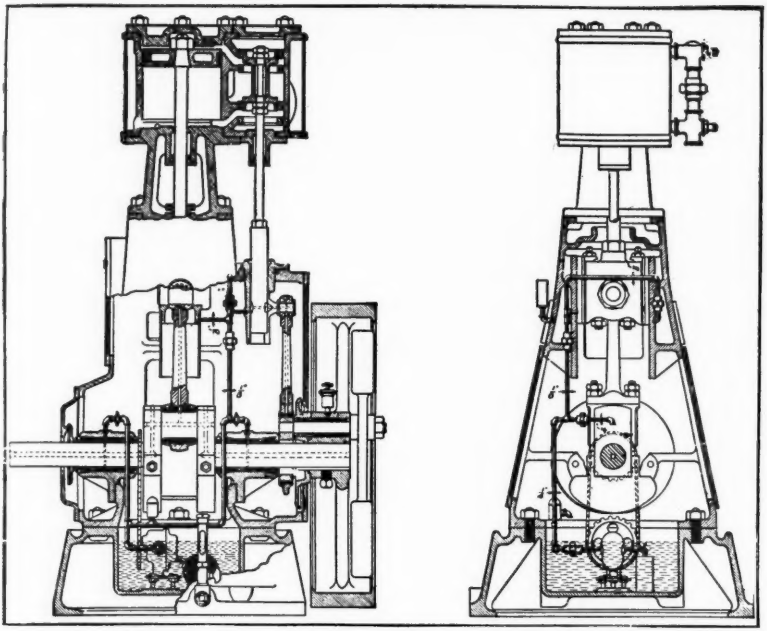


Figure 4—Pressure System on Sturtevant Vertical Engine

the various bearings. The oil returns to the bottom of the case and is used again. A baffle plate is provided to prevent an excessive quantity of cylinder condensation from getting to the crank case, and an automatic water overflow takes care of the little water that works thru the stuffing boxes. This overflow should be kept open at all times so as to make it possible to tell when the oil starts to overflow.*

The Griscom-Russell Company, New York City, also are recommending Texaco Regal Oil for the enclosed crank case of the Russell Splash oiled horizontal engine.

The Skinner Engine Company of Erie, Pa., who build the well-known Skinner Engine equipped with the self-oiling and automatic filtration system, have tested out Texaco Regal Oil and have approved its use on their engine. This oiling system is used on the Skinner Uniflow Engine, as well as on the Slide Valve Type.

The oiling system of the Sturtevant Engine, built by the B. F. Sturtevant Company of Hyde Park, Boston, Mass., is shown in the accompanying illustration. This company has also found Texaco Regal Oil very satisfactory for lubricating their vertical engines.

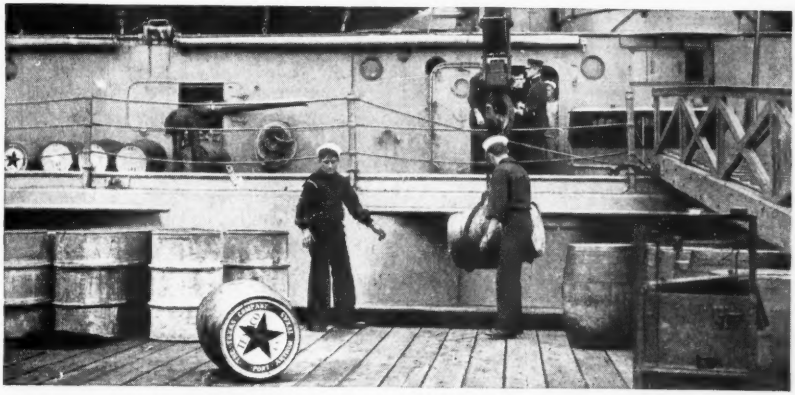
Texaco Regal Oil is of the proper body at the working temperature to provide the necessary lubricating film between the bearing surfaces.

It will separate readily from water, thus permitting the cylinder condensation and moisture condensed from the atmosphere to be drained off.

It will not form an emulsion when churned up with the water in the crank case.

It will not evaporate at working temperatures when churned up with air in the crank case.

Lubrication, Vol. V, No. 2, Dec. 1917, p. 8.



This Picture Was Taken Before We Entered the War

AS a matter of fact, it was taken before the Hun invaded Belgium. But similar snapshots might be taken (if it were allowed) at any port on this side, or "Over There."

Because—ALL of Uncle Sam's ships, in ALL waters, are using TEXACO LUBRICANTS.

They were using them THEN—they are using them NOW.

That includes Dreadnaughts, Battleships, Supply Boats, Colliers, Transports, Patrol Boats—Everything.

The power units include turbines, reciprocating engines, Diesel engines, and gasoline motors of all types.

Think of the range of work. Remember the necessity for utmost lubricating efficiency and you will get some idea of the magnitude and scope of the job.

A high degree of service, in the action of the oils themselves, and in deliveries must be maintained.

Uncle Sam gets it from us.

And any of his nephews operating plants or shops in any part of this country, can get the same kind of service from The Texas Company.

There is a Texaco Lubricant for every purpose.

Tell us your needs, we will give you the oil you need.

THE TEXAS COMPANY

DEPT. H, 17 BATTERY PLACE, NEW YORK CITY

HOUSTON CHICAGO NEW YORK

OFFICES IN PRINCIPAL CITIES

Gossip That Costs Human Lives!

HAVE YOU HEARD LIES LIKE THESE?

THAT President Wilson's Secretary, Mr. Tumulty, was shot for treason at Fort Leavenworth.

THAT a sweater knit in St. Louis for the soldiers in France was sold by Red Cross workers.

THAT no soldier or sailor, after leaving American soil, can write home.

THAT Red Cross officials receive exorbitant salaries.

THAT homes displaying Food Pledge cards will be searched by Government agents.

THAT this is a "business man's war."

THAT there are 10,000 Englishmen in Utah waiting to seize America for Great Britain.

YOU heard the story about the Red Cross official who sold a sweater knitted for the soldiers?

Did you believe it? Did you repeat it?

Do you know that stories like that are lies started by German spies? Do you know that you are helping the Kaiser and *hurting our soldiers* every time you repeat such rumors?

Oh, they are clever stories—interesting stories—they make splendid gossip whenever women gather. Of course they are! The Kaiser pays his spies to make them clever so that people will repeat them.

That's how they spread and spread and grow and grow until a lot of people hear them. Discontent is sowed. The very national unity of this country is attacked.

That's how German agents are trying to slow up our preparations. That's how, unless these lies are nailed, they will prolong the war, impede the transport of our food, supplies and soldiers—yes, that is how these lies will kill our boys in France!

Of course you do not realize these consequences when you pass along a story you have heard. But you owe it to yourself to get "THE KAISERITE IN AMERICA"—101 German Lies—the newest publication of the Committee on Public Information in Washington. See how the German agents have invented lies—even to giving names and dates and places.

Read the 101 German lies that one newspaper ran down and proved to be utterly false. How many of them have you heard?

Your boys can fight the enemy abroad You can fight the enemy at home. However harmless all these stories seem, don't repeat them! Don't listen to them! Get this book and see how you can help to beat the Kaiser at his game at home! It's free!

COMMITTEE ON
PUBLIC INFORMATION
8 Jackson Place, Washington, D. C.

Get the Facts
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from Washington
United States Gov't Comm. on Public Information

THIS SPACE CONTRIBUTED FOR THE WINNING OF THE WAR BY
THE TEXAS COMPANY, Petroleum and Its Products
New York—Chicago—Houston

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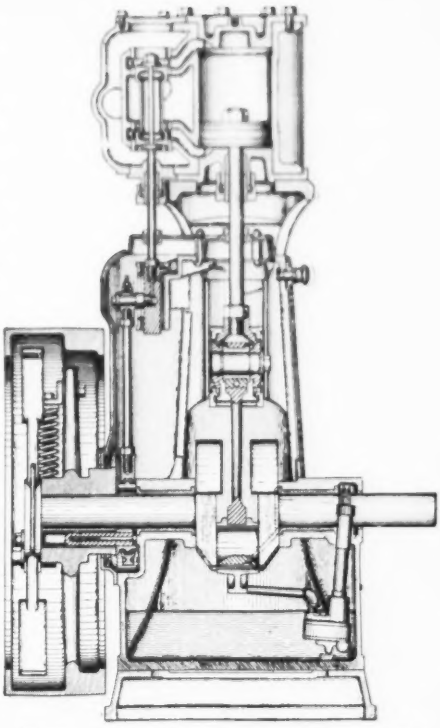

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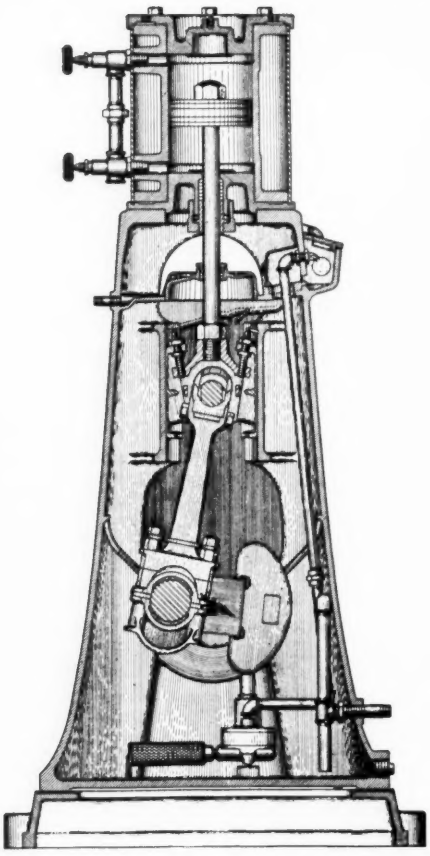

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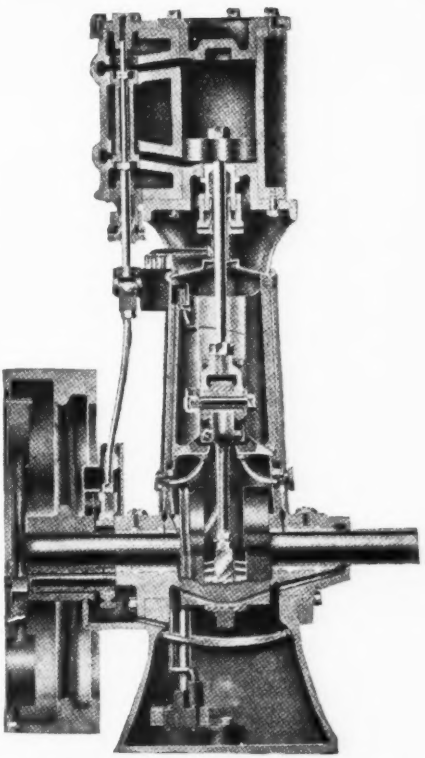

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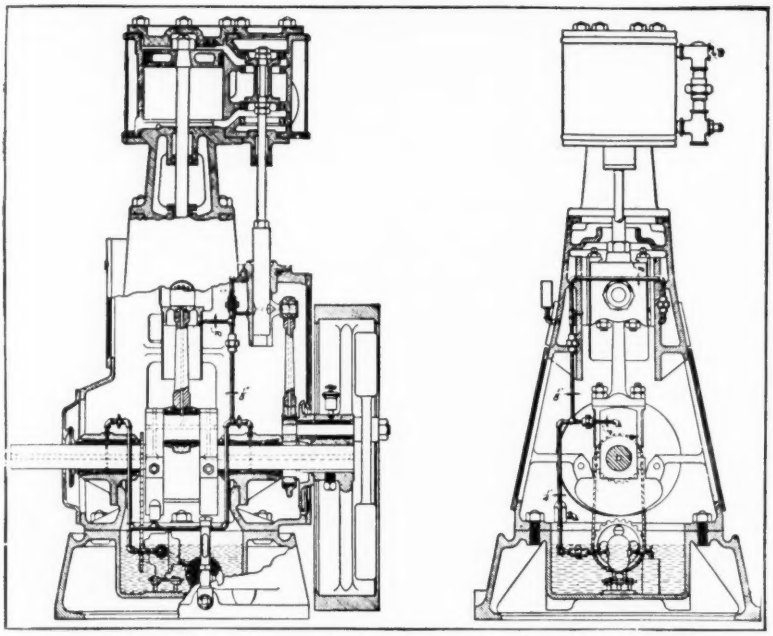

Figure 4—Pressure System on Sturtevant Vertical Engine

the various bearings. The oil returns to the bottom of the case and is used again. A baffle plate is provided to prevent an excessive quantity of cylinder condensation from getting to the crank case, and an automatic water overflow takes care of the little water that works thru the stuffing boxes. This overflow should be kept open at all times so as to make it possible to tell when the oil starts to overflow.*

The Griscom-Russell Company, New York City, also are recommending Texaco Regal Oil for the enclosed crank case of the Russell Splash oiled horizontal engine.

The Skinner Engine Company of Erie, Pa., who build the well-known Skinner Engine equipped with the self-oiling and automatic filtration system, have tested out Texaco Regal Oil and have approved its use on their engine. This oiling system is used on the Skinner Uniflow Engine, as well as on the Slide Valve Type.

The oiling system of the Sturtevant Engine, built by the B. F. Sturtevant Company of Hyde Park, Boston, Mass., is shown in the accompanying illustration. This company has also found Texaco Regal Oil very satisfactory for lubricating their vertical engines.

Texaco Regal Oil is of the proper body at the working temperature to provide the necessary lubricating film between the bearing surfaces.

It will separate readily from water, thus permitting the cylinder condensation and moisture condensed from the atmosphere to be drained off.

It will not form an emulsion when churned up with the water in the crank case.

It will not evaporate at working temperatures when churned up with air in the crank case.

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